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Flat Planting of Sugarcane on Graded Land

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by

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Agricultural Research Service
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Cooperating

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INTRODUCTION:

Louisiana Sugarcane Land is divided into cuts approximately 1,000 feet long and of varying widths; an average 20-row-cut being 130 feet wide. A lateral ditch approximately 30 inches deep borders the cut on each side and and access road or headland crosses each end. The cane is grown on bedded rows 18 inches high, spaced 6 feet apart to facilitate drainage. To provide an outlet for water accumulating in these deep row middles, a field or "quarter" drain is cut across the beds to the lateral ditches. Under average conditions, there are four of these quarter drains per cut.

A quarter drain is constructed by plowing a furrow through the bedded rows of sufficient depth to provide a positive drain from the row middles to the lateral ditch. In plowing the furrow, the loosened earth forms a block in the row middles which prevents the water from entering the quarter drain. This block of loosened earth has to be removed by hand with a shovel. The operation is known as "shoveling out the eyes." The quarter drains require maintenance after each cultivation by replowing the furrow and shoveling out the eyes. Sugar planters report that the maintenance of quarter drains averages $2.52 per acre per year, a cost approximately equalling the cost of cultivation.

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Early cooperative State-Federal studies showed that by precision grading and land smoothing, drainage of sugarcane land could be considerably improved (1 and 2)[2].

The test was of one cycle of sugarcane consisting of one plant cane crop, and first and second year stubble crops.

The possibility of growing sugarcane on flat or nearly flat bedded rows to reduce the necessary depth of quarter drain seemed possible under the improved drainage conditions of graded land and in turn reduce the maintenance cost.

Louisiana Agricultural Experiment Station's flat-planting studies on ungraded land conducted in 1926 through 1930 resulted in better yields and drainage [3]. However, with the shallow cultivation used at that time, the cost of weed control by hand hoeing in drill row was excessive because the implements did not throw sufficient earth to cover and control the weeds. Chemical weed control was not developed at that time.

Exploratory studies, utilizing modern equipment and chemical weed control on graded land, were initiated on the Westover Plantation, Port Allen, Louisiana, in 1949. This study was on mixed land (1).

There are three broad classifications of land in the sugarcane area of Louisiana, which are spoken of as sandy, mixed, and heavy black. The sugarcane area is an alluvial area and the gradations of land follow the general drainage pattern of the area. The drainage is away from the main streams to the swamps or bayous and is spoken of as from front to back. The higher land (front land) nearest to the main streams consists of fine stream sediments and are sandy, gradually becoming heavier as the swamps are approached. The back lands near the swamps are a heavy black clay with a mixture of sand, silt and clay of various gradations lying between the sandy and black land. Internal drainage of the lands varies with the type of land, with the front sandy lands having very good internal drainage grading to practically a zero internal drainage in the back black land.

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[2] Numbers in parentheses refer to literature citations page 10

[3] Verbal report W. G. Taggart, April, 1956

Sugarcane requires good drainage, especially during the winter months when the sugarcane is in a semi-dormant stage. (Sugarcane is a ratoon crop.)

Wet, cold conditions during this period are inducive to diseases such as red root and Phytophythora rot attacking the semi-dormant mother cane and, in turn, affects the stand of the forthcoming crop.

The flat-planted area on the exploratory test on Westover Plantation outyielded the row planted areas and a stand was successfully carried over winter.

In 1951 and 1952 flat-planting experiments were set up on the St. Delphine Plantation, Addis, La. and the Cinclare Plantation, Cinclare, La. The Louisiana Agricultural Engineering Experiment Station cooperated in the cultivating of the crop and the Louisiana Experiment Station Plant

Pathology Department on the chemical weed control.

EXPERIMENTAL PROCEDURE:

Grading - The St. Delphine and Cinclare test sites were graded with bulldozers, scrapers, and smoothed with land levelers to give the cuts a slight crown or slope from ditch to ditch (3, 4, 5, 6). They were graded to a slope of 0.2 feet per 100 feet to give the areas adequate surface drainage. After grading they were ripped approximately 12 inches deep with a Graham Hoeme plow to remove the compaction caused by the grading and smoothing operations. The grading work included grading both the flat-planting sites and the row planted sites which were to be used in evaluating the results. A mixed land and a black land area was planted on each plantation.

Planting - The first area was planted by opening a furrow into the flat field. The sugarcane stalks were placed in the furrow and covered with the conventional cane disc chopper mounted on a tool bar. Difficulty was experienced in obtaining sufficient earth to cover the cane. After covering, the earth was compacted over the cane with a sugarcane roller.

Later plantings were made by setting the field up in the conventional type sugarcane bedded row. The cane was placed in the row using a conventional type chopper (disc) with a short drag of railroad rails drawn behind to smooth the area. The area was then rolled with conventional sugarcane roller to compact the earth around the cane. This was a satisfactory method of placing and covering and the field was left reasonably flat.

On one test area the experimental sugarcane planter developed by the Agricultural Engineering Branch at Houma, Louisiana was used with satisfactory results.

Even under flat-planting the free flow of water from the row middle to the lateral ditch is restricted due to the two to three-inch-deep furrow made by the tractor wheels.

Shallow quarter drains, installed with a plow, were required to drain this water from the row middles to the lateral ditch.

Cultivating - The following spring after planting the cane was shaved lightly with the conventional cane shaver and off-barred. The middles were ripped twice with a series of teeth mounted on a conventional I.H.C. model M tractor tool bar before starting the shallow cultivation. The first ripping was twelve to fourteen inches deep and the second was five to six inches deep. The ripping closed the furrows made by off-barring. After ripping, the crop was fertilized, using Anhydrous Ammonia.

Two or three shallow cultivations were made with a 4-row cotton cultivator which had been modified into a 3-row sugarcane shallow cultivator equipped with 12- and 16-inch cotton sweeps.

Harvesting - The first crop of plant cane was cut by hand. The later crops of cane were cut with the conventional cane harvester. Burning, piling and loading were also done with conventional cane equipment and methods. No difficulty was met in using any of the standard sugarcane equipment in harvesting the crop.

Records of cane yields and cultivation costs were kept for both the flat planted and planted areas.

RESULTS:

The yield data from the test areas are shown in Figs. 1 and 2.

Fig. 1 lists the yield data for the tests on graded black land. It will be noted that the St. Delphine test area showed an increase for the flat cane over the row-planted cane of approximately three tones per acre and a decrease of first stubble cane of 2.54 field tons and 2.75 standard converted tons. Visual observations in the field showed some settling of the low areas that were filled in grading and did not adequately drain. This may account for the reduced yield since the stand of cane was impaired in these particular areas.

On the Cinclare test area there was practically no increase in the plant cane but a substantial increase in the stubble cane of 5.35 field tons and 4.71 standard converted tons. The yield data for the entire test did not show a significant increase in yields for the flat planted cane on black land. However, it did maintain its yields, having an average increase of .87 tons of field cane and 1.42 standard converted tons.

Fig. 2 lists the yield data for mixed land and in all instances with the exception of one year (1954 on the St. Delphine test area), the flat planted cane outyielded the row planted cane ranging from 1.57 field tons to 11.19 field tons of cane. The project has not been able to explain the reduction in yields in 1954 on the St. Delphine test area.

Fig. 1
Yield Data
Graded Black Land

	Row Planted					Flat Planted					
			Net Field	Yield Per Acre				Net Field	Yield Per Acre		
	Date	Acre	Tons	Field	Std.	Date	Acre	Tons	Field	Std.	Location
Variety 34-120											
Plant Cane	12/11/51 12/12/51	10.87	234.64	21.59	*	12/11/51	4.72	116.72	24.73	*	St. Delphine
Stubble	10/28/52	10.87	289.88	26.67	25.99	10/28/52	4.72	113.92	24.13	24.14	"
Plant Cane	11/13/52	10.87	324.80	29.88	28.80	11/18/52	3.66	111.14	30.36	28.44	Cinclare
Stubble	10/16/53	6.76	127.13	18.80	22.72	10/16/53	3.66	88.40	24.15	27.43	"
Average				24.80	24.77				25.67	26.19	
Increase									.87	1.42	

Fig. 2
Yield Data
Graded Mixed Land

	Row Planted					Flat Planted					
			Net Field	Yield Per Acre				Net Field	Yield Per Acre		
	Date	Acre	Tons	Field	Std.	Date	Acre	Tons	Field	Std.	Location
Variety 36-105											
Plant Cane	12/9/51	11.03	283.09	25.66	*	12/9/51	3.94	120.29	30.53	*	St. Delphine
Stubble	10/29/52	14.31	442.78	30.94	27.69	10/28/52	3.92	134.48	34.30	31.07	"
Variety 34-120											
Plant Cane	11/19/52	11.38	273.42	24.03	22.00	11/15/52	4.42	144.55	32.70	30.76	Cinclare
Stubble	10/14/53	32.72	794.20	24.27	27.42	10/15/53	4.42	112.62	25.48	28.99	"
Variety 36-105											
Plant Cane	11/1/54	8.72	286.82	32.89	33.32	11/1/54	3.94	121.99	30.96	31.51	St. Delphine
Stubble	11/1/55	8.72	168.27	19.29	19.50	11/1/55	3.94	105.21	26.70	31.69	"
Average				25.88	25.93				30.07	30.76	
Increase									4.19	4.83	

* Figs. 1&2: Early freeze - unable to convert to std. tons. Calculations assume std. tons same as field.
Std. Ton Sugarcane contains 12% Sucrose - 76.5% Purity

The yield data for the entire test of six crop years on graded mixed land shows an increase of 4.19 field tons of cane and 4.83 standard converted tons of the flat planted cane over the row planted cane. Statistically, this is practically a significant difference at the 5% level and since there were only two treatments, the 5% level required a very high significant difference. From a sugarcane planter's standpoint the increase is more than significant monetarily.

Cultivation Costs - The Louisiana Agricultural Engineering Department reported that the average cost of cultivating the flat planting of sugarcane was $1.00 per acre as compared to an average of $2.00 per acre for the cultivation of sugarcane planted on bedded rows as reported by the plantation manager.

The number of cultivations were practically the same but there was a saving, both in power and time consumed. The implements used for shallow cultivation cultivated three rows at a time while the conventional sugarcane cultivator cultivated only one row.

Weed Control - Good weed control was obtained by the combination of shallow cultivation and chemical weed control in the drill row. The cane rooted into the row middles and supported the cane stock which resulted in an erect stand that did not lodge.

Maintenance of Quarter Drains - The shallow quarter drains permitted under flat planting were opened in the spring of the year at a cost of $.98 per acre, and no further maintenance was required the remainder of the crop year. This single low-cost operation of opening the drains is compared to the usual cost of $2.52 per acre under conventional row planting.

In addition to the reduced maintenance required for the quarter drains, a number of field advantages were observed, i.e. (a) In the harvesting operation, the cane wagons were able to pull across the rows and clear the loader for the next wagon while the slings were being hooked. (b) Walking was much easier for the harvesting and scrapping crew in the flat planted area resulting in better work than on the row planted area. (c) When two wagons were used per tractor in hauling cane, the inside wheel of the second cart did not have to pull over a high row when coming on the head land. This is an advantage when the head lands are wet and slippery. (d) The fields are cut up less in harvesting in wet times. Tractors and wagons have more area to travel in the flat planted area and are not confined to the narrow "V" in the middle of the row planted cane.

Miscellaneous Observations - While intensive measurement of soil temperature, soil moisture, stand count, and growth have not been made, the general trend of observations made by the Louisiana Agricultural Engineering Department (7) indicates that there was little difference between the flat planted cane land and the row planted cane as to soil temperature, moisture, and stand count.

CONCLUSIONS:

Reduction of the cost of quarter drains on graded sugarcane land without adversely affecting the crop yield appears to be possible plus a number of cultural advantages.

The yield data from the flat planted cane on graded land when compared with row planted cane on graded land shows an increase in yields of approximately four tons can be expected on mixed land and approximately one ton on black land.

Quarter drains on flat planted cane only require opening in the spring of the year at a cost of $.98 per acre as compared with $2.52 per acre as reported for the maintenance of quarter drains in planted cane.

Cultivation costs are reduced approximately half with flat planted cane since it is adaptable to shallow cultivation using multi-row cultivators for approximately half of the cultivating period.

Field observations of the test indicate a number of harvesting advantages, such as more mobility of harvesting equipment with the absence of the rows, easier walking for the scrapping crews, easier hauling and less damage to the field during wet periods of harvest.

There is little difference in soil temperature, soil moisture, and stand count between the flat planted cane land and the row planted cane.

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